PART I - ADMINISTRATIVE

Section 1. General administrative information

Title of project

Assessing Summer And Fall Chinook Restoration In The Snake River Basin

BPA project number: 9403400
Contract renewal date (mm/yyyy): 1/2000 ☐ **Multiple actions?**

Business name of agency, institution or organization requesting funding
Nez Perce Tribe Department of Fisheries Resources Management

Business acronym (if appropriate) NPT

Proposal contact person or principal investigator:

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NPPC Program Measure Number(s) which this project addresses
7.3B.2, 7.4B.1, 7.5B.1, 7.5B.3

FWS/NMFS Biological Opinion Number(s) which this project addresses
Section 10 permit 1134.

Other planning document references
National Marine Fisheries Service Proposed Recovery Plan for Snake River Salmon (March, 1995), Chapter V, Section 4, p V-4-15 Monitoring and Evaluation Strategy; Chapter V, Section 4, p V-4-40 4.7 Biological Objective and p V-4-42 4.7.d; and Chapter V, Section 4, p V-4-43 4.8 Biological Objective. In relation to the Tribal Recovery Plan WY-KAN-USH-MI WA-KISH-WIT (1996), the plan states that "the intention of Tribal supplementation proposals is to increase the abundance of naturally reproduicing populations through outplanting while keeping genetic risk at acceptable levels", and "the increase in survival and reproduction capacity gained through the use of artificial propagation in supplementation and reintroduction programs is necessary to recover stocks in a timely fashion" and recommends to: "develop experimental and monitoring programs in association with these projects to study the relationships between natural and supplemented components of the populations."

Short description
Assess current fall chinook spawning escapement and locations, juvenile emergence, growth rates, emigration timing, survival to dams, and smolt-to-adult survival for evaluating supplementation as a tool for recovery of Snake River fall chinook salmon

Target species
Oncorhynchus tschawytscha-fall chinook salmon

Section 2. Sorting and evaluation

Subbasin
Clearwater, Grande Ronde, Salmon, Imnaha

Evaluation Process Sort

CBFWA caucus	Special evaluation process	ISRP project type
Mark one or more caucus	If your project fits either of these processes, mark one or both	Mark one or more categories
☒ Anadromous fish ☐ Resident fish ☐ Wildlife	☒ Multi-year (milestone-based evaluation) ☐ Watershed project evaluation	☐ Watershed councils/model watersheds ☐ Information dissemination ☐ Operation & maintenance ☐ New construction ☒ Research & monitoring ☐ Implementation & management ☐ Wildlife habitat acquisitions

Section 3. Relationships to other Bonneville projects

Umbrella / sub-proposal relationships. List umbrella project first.

Project #	Project title/description
20541	Snake River Fall Chinook Studies
9403400	Assessing Summer and Fall Chinook Restoration in the Snake River Basin.
9801004	M&E of Yearling Snake R. Fall Chinook Released Upstream of L. Granite
9801003	Monitor and Evaluate the Spawning Distribution of Snake R. Fall Chinook
9102900	Life History and Survival of Fall Chinook Salmon in the Columbia R. Basin
9302900	Survival Est. for the Passage of Juvenile Salmonids Through Dams and Res.
9801005	Pittsburg Landing, Capt.John Rapids and Big Canyon Fall Chin Accl. Facil.

Other dependent or critically-related projects

Project #	Project title/description	Nature of relationship
9801004	Monitoring and Evaluation of Yearling Snake River fall chinook	Monitoring of fall chinook adult returns through aerial redd surveys

		and carcass recovery to determine hatchery contributions, and use of jet boat and staff to assist in the yearling fall chinook telemetry studies
		This project also depends on staff from Project 9801004 to assist in seining and collection of juvenile fall chinook

Section 4. Objectives, tasks and schedules

Past accomplishments

Year	Accomplishment	Met biological objectives?
1994	Determined the chinook salmon optimal spawning timing window based on water temperatures in the upper Clearwater River and principal tributaries, Grande Ronde, Salmon, and Imnaha Rivers	Water temperature data were collected and thermal temperature units calculated to describe when successful incubation could occur in relation to an October and/or a November spawning chinook
1994	Evaluated the quantity and quality of chinook spawning habitat in the upper mainstem Clearwater, Middle Fork Clearwater, and lower sections of South Fork Cleawater, Selway, and Lochsa	Spawning habitat quantity was physically measured and based on depth, velocity and substrate size; habitat quality was measured by using the tri-tube freeze-core technique at potential spawning locations
1994	Determine the extent of current fall chinook spawning activity and hatchery contributions in the Clearwater and major tributaries, Grande Ronde, and Salmon Rivers and coordinate redd locations on the Imnaha River with the USFWS and Idaho Power Company	This is an ongoing objective to monitor fall chinook adult escapement through aerial redd surveys, collect biological information and determine hatchery fish contributions to the natural spawning population by collecting carcasses of spawned fish
1994	Describe fall chinook life history strategies (emergence timing, growth rates, emigration timing and survival) in the Clearwater and Grande Ronde Rivers	This is an ongoing objective to calculate emergence timing based on temperature units, capture and PIT tag wild subyearling fall chinook to measure growth rates, emigration timing and survival to the mainstem dams
1995	Provided an annual report on the results of the first year of study	A 1994 annual report: Assessing Summer and Fall Chinook Salmon Restoration in the Upper Clearwater River and Principal Tributaries was

		published by BPA
1996	Evaluated the quantity and quality of chinook spawning habitat in the lower Grande Ronde, Salmon, and Imnaha Rivers	Spawning habitat quantity was physically measured and based on depth, velocity and substrate size; habitat quality was measured by using the tri-tube freeze-core technique at current or potential spawning locations
1997	Described the movement patterns, growth rates and emigration survival of Lyons Ferry Hatchery fall chinook released in the Clearwater River	This is an ongoing objective to describe the best supplementation strategy (size and release time) to obtain the highest juvenile emigration survival and for enhancing Snake River fall chinook natural production
1997	Prepared a cooperative BPA report with NMFS and USFWS	A cooperative report entilted: Passage Survival of Hatchery Subyearling Fall Chinook Salmon to Lower Granite, Little Goose, and Lower Monumental Dams, 1996 was sent to BPA
1998	Collected a subsample of wild subyearling chinook salmon from the Clearwater and Grande Ronde Rivers to determine fall chinook stock structure through genetic analysis	This is an ongoing objective to describe the genetic relationship between the Snake River fall chinook and other Columbia River fall chinook stocks
1998	Provided a 1995-96 report to BPA	A draft 1995-96 report has been submitted to BPA and distributed for peer review comments

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Describe the movement patterns, growth rates, life history characteristics, emigration survival, and stock structure of wild and hatchery fall chinook released in the Clearwater and Grande Ronde Rivers	a	Capture up to 8,000 wild fall chinook by beach seining and use PIT tags to describe movement patterns, growth rates, emigration timing and survival through recaptures and detection data at the mainstem dams
1		b	Obtain a subsample of up to 120 wild chinook salmon from each study stream for chinook stock identification i.e. either spring/summer or fall chinook and

			to describe stock structure i.e. Snake River and/or mid-Columbia River fall chinook
1		c	Obtain 24,000 Lyons Ferry Hatchery fall chinook subyearlings to PIT tag, acclimate, and release in the Clearwater River at the Big Canyon Creek Acclimation Facility to measure emigration survival
1		d	In cooperation with NMFS, PIT tag and direct stream release 7,500 Lyons Ferry Hatchery fall chinook subyearlings at the Big Canyon Creek Facility as a comparison to previous studies and to the acclimated releases in task c
1		e	Recapture (through task a) Lyons Ferry Hatchery subyearling fall chinook released in tasks c and d to obtain movement patterns, growth rates, emigration timing and survival through detection data at the mainstem dams
1		f	Analyze PIT tag detection information at mainstem dams and use the Survival Under Proportional Hazards (SURPH) model to estimate juvenile survival of hatchery and wild fall chinook salmon through the lower Snake River hydro system
2	Determine fall chinook adult escapement and spawning success in the Clearwater, Grande Ronde and Salmon Rivers and coordinate with the USFWS and Idaho Power Company on the Snake and Imnaha Rivers	a	Conduct weekly aerial spawning surveys by helicopter from the first week in October to the first week in December to determine fall chinook salmon spawning timing, total redd number and the fall chinook spawning distribution
2		b	Obtain locations of radio tagged hatchery fall chinook salmon adults during aerial redd surveys in task 2a to help determine hatchery fish spawning contributions (in cooperation with Project 9801004)
2		c	Conduct fall chinook deep water redd surveys using underwater video in systematic sampling locations in

			the Clearwater River to determine the extent of deep water spawning activity
2		d	Collect fall chinook carcasses in all study streams for biological information (length, weight, percent spawned, scale analysis) and to determine hatchery contributions through coded wire and elastomer tag recoveries
3	Correlate juvenile wild and hatchery fall chinook survival in study streams to emigration conditions and environmental variables to adult returns	a	Gather mainstem temperature and flow data and operational conditions at dams to correlate juvenile survival rates estimated in task 1f and to adult returns as reported over Lower Granite and redd counts and carcasses collected in tasks 2a, 2c, and 2d
3		b	Deploy thermographs and monitor water temperatures in Clearwater, North Fork, Middle Fork and South Fork Clearwater, and the lower sections of the Grande Ronde, Salmon, and Imnaha Rivers to relate juvenile emigration timing and survival and adult spawning
4	Provide reports on the technical findings, project status, and budget status	a	Provide project status reports on a quarterly basis to BPA
4		b	Provide a draft annual report and/or a scientific journal paper on the technical findings for peer review by regional scientists with expertise in this type of research
4		c	Provide a final annual report and/or scientific journal paper for publication and distribution that incorporates any necessary changes resulting from peer review comments

Objective schedules and costs

Obj #	Start date mm/yyyy	End date mm/yyyy	Measureable biological objective(s)	Milestone	FY2000 Cost %
1	5/2000	5/2001	Fall chinook life history characteristics, emigration survival through mainstem dams, and the current genetic stock structure of wild and hatchery fall chinook salmon		35.00%
2	10/2000	12/2000	Determine fall chinook adult escapement and spawning success in the Clearwater, Grande Ronde and Salmon Rivers and coordinate with the USFWS and Idaho Power Company on the Snake and Imnaha Rivers		25.00%
3	1/2000	12/2000	Correlate juvenile wild and hatchery fall chinook survival in study streams to emigration conditions and environmental variables to adult returns		15.00%
4	4/2000	4/2001	Report on the technical results		25.00%
				Total	100.00%

Schedule constraints
Availability of Lyons Ferry Hatchery subyearling fall chinook salmon to continue supplementation survival research for at least five consecutive years which would be completed by the year 2001

Completion date
2006

Section 5. Budget

FY99 project budget (BPA obligated): $304,800

FY2000 budget by line item

Item	Note	% of total	FY2000
Personnel		%39	122,000
Fringe benefits		%8	25,040
Supplies, materials, non-expendable property		%1	3,000
Operations & maintenance		%1	4,000
Capital acquisitions or improvements (e.g. land, buildings, major equip.)		%0	0
NEPA costs		%0	0
Construction-related support		%0	0
PIT tags	# of tags: 32,000	%29	92,800
Travel		%3	10,500
Indirect costs		%12	37,482
Subcontractor	Valley Helicopter Service	%4	12,000
Subcontractor	WDFW Genetics Laboratory	%3	10,000
Other		%0	0
TOTAL BPA FY2000 BUDGET REQUEST			$316,822

Cost sharing

Organization	Item or service provided	% total project cost (incl. BPA)	Amount ($)
		%0	
		%0	
		%0	
		%0	
Total project cost (including BPA portion)			$316,822

Outyear costs

	FY2001	FY02	FY03	FY04
Total budget	$323,400	$225,000	$235,000	$245,000

Section 6. References

Watershed?	Reference
☐	Arnsberg, B.D., W.P. Connor, and E. Connor. 1992. Mainstem Clearwater River study: assessment for salmonid spawning, incubation, and rearing. Nez Perce Tribe Department of Fisheries Final Report to the Bonneville

	Power Administration, Project 88-15.
☐	Arnsberg, B.D., and D.P. Statler. 1995. Assessing summer and fall chinook salmon restoration in the upper Clearwater River and principal tributaries. Nez Perce Tribe Department of Fisheries Annual Report to the BPA, Project 94-034.
☐	Arnsberg, B.D. 1998. Assessing summer and fall chinook salmon restoration in the Snake River basin. Nez Perce Tribe Department of Fisheries 1995-96 Draft Report to the Bonneville Power Administration, Project 94-034.
☐	Bjornn, T.C., and N. Horner. 1980. Biological criteria for classification of Pacific salmon and steelhead as threatened or endangered under the Endangered Species Act.
☐	Blankenship, H.L., L. LaVoy, C. Knudsen, A. Marshall, D. Thompson, and J. Sneva. 1997. Stock Identification of Snake River fall chinook salmon, Chapter 2 . Washington Department of Fish and Wildlife Final Report to BPA. Project No. 92-046.
☐	Chapman, D. and others. 1991. Status of Snake River chinook salmon. Don Chapman Consultants, Inc. for the Pacific Northwest Utilities Conference Committee. Boise, Idaho.
☐	Cramer, S.P. 1995. Selway River genetic resource assessment. Supplement to Nez Perce Tribal Hatchery Genetic Resource Assessment prepared for the Nez Perce Tribe, Lapwai, Idaho.
☐	Hoss, S. 1970. Evaluation of salmon and steelhead reintroductions into the Clearwater River drainage, Idaho. State of Idaho Fish and Game Department. Columbia River Fisheries Development Program. Project No. 1612-B, Contract No.14-17-0001-1857.
☐	Muir, W.D., S.G. Smith, E.E. Hockersmith, M.B. Eppard, W.P. Connor, and B.D. Arnsberg. 1998. Passage survival of hatchery subyearling fall chinook salmon to Lower Granite, Little Goose, and Lower Monumental Dams, 1996 in BPA Project 9102900.
☐	Parkhurst, Z.E. 1950. Survey of the Columbia River and its tributaries. Special Scientific Report No. 39, Part 6. U.S. Fish and Wildlife Service, Washington, D.C.
☒	Smith, S.G. , J.R. Skalski, J.R., J.R., J.W. Schlechte, A. Hoffmann, and V. Cassen. 1994. Statistical survival analysis for fish and wildlife tagging studies. Manual submitted by Center for Quantitative Science, School of Fisheries, U of W to the BPA.
☒	Steward, C.R., and B.D.Arnsberg. 1998. Fall chinook broodstock management plan for the Clearwater River subbasin in Arnsberg 1998 Assessing summer and fall chinook salmon restoration in the Snake River Basin. BPA Project 94-034.
☒	WDF (Washington Department of Fisheries). 1993. Stock composition of fall chinook at Lower Granite Dam in 1992. Columbia River laboratory progress report 93-5. Battleground, WA.
☒	WDF (Washington Department of Fisheries). 1994. Stock composition of fall chinook at Lower Granite Dam in 1993. Columbia River laboratory progress report 94-10. Battleground, WA.

PART II - NARRATIVE

Section 7. Abstract

The goal of this project is to collect life history and survival information on wild Snake River fall chinook and to evaluate supplementation strategies that would be favorable for the recovery and restoration of summer and fall chinook in the last remaining mainstem habitats in the Snake River basin above Lower Granite Dam. Not including the Snake River, these mainstem study streams are the Clearwater River and principal tributaries, the lower Grande Ronde River, Salmon River and Imnaha River.

The 1994 Columbia River Basin Fish and Wildlife Program, Section 7.3B.2, called on Fishery Managers to: "...implement the high priority supplementation projects including design, construction, operation, maintenance, monitoring and evaluation." And Section 7.5B.1 states: "...as quickly as possible and in consultation with the National Marine Fisheries Service, develop an experimental design for implementing, monitoring and evaluating supplementation of and, if appropriate, a captive broodstock program for Snake River fall chinook."

We assessed current water temperatures that may limit spawning and rearing timing for chinook salmon in study streams. Chinook salmon spawning habitat quality and quantity was measured in all study streams to determine egg incubation success and spawning habitat availability. We are continuing to investigate life history characteristics of naturally produced Snake River fall chinook in the Clearwater and Grande Ronde Rivers and are evaluating supplementation success of Lyons Ferry Hatchery subyearling fall chinook released upstream of Lower Granite Dam.

Fall chinook subyearling supplementation research will continue for at least five years or until 2001. A significant increase in adult returns from supplementation fish and contribution to natural production will be the key determination of success. Successfully spawning adults will be monitored through 2006 by aerial redd surveys and carcass collections on the spawning grounds. Results will provide salmon managers with data and recommendations on what life stage release strategy would return the greatest number of successfully spawning adults and would contribute to the delisting of the ESA listed Snake River fall chinook.

Section 8. Project description

a. Technical and/or scientific background

We are studying summer and fall chinook salmon recovery and restoration potential because these stocks were historically present in most major tributaries of the Snake River and are currently extinct or on the brink of extinction. The Snake River spring/summer and fall chinook stocks were listed as threatened in 1992 under the

Endangered Species Act (ESA). Fall chinook escapement to the Snake River basin was estimated to average 72,000 annually from 1939-1949 and declined to an average of 29,000 adults from 1950-1959 (Bjornn and Horner 1980). Even as late as 1968, fall chinook counts at Ice Harbor Dam was about 20,000 fish. Since the last dam (Lower Granite) was constructed on the lower Snake River in 1975, adult fall chinook counts have decreased to an average of 600 fish between 1975 and 1980. Natural fall chinook returns fell to a record low of 78 in 1990 and increased to 318 in 1991, 533 in 1992 (WDF 1993), and 742 in 1993 (WDF 1994). Adult counts decreased again in 1994 to 406 and 350 in 1995. Since 1995 we have seen a slight upward trend in the number of fall chinook adults counted at Lower Granite Dam.

In the Clearwater River subbasin, chinook salmon runs were virtually eliminated by the construction of the Washington Water Power Diversion Dam in the lower river in 1927 (Parkhurst 1950). A crude fish ladder was built on the dam which was able to pass steelhead during higher flow periods but proved almost impassible during lower flows when chinook salmon arrived. The ladder was modified in later years but not before the chinook runs were decimated. The dam on the lower Clearwater River was removed in 1972 and Dworshak Dam and Dworshak National Fish Hatchery was built upstream on the North Fork Clearwater. Dworshak Hatchery mitigates for steelhead losses in the North Fork and has reintroduced spring chinook mainly through releases at the hatchery facility. No reintroduction effort was given to summer and fall chinook after dam removal. The Idaho Department of Fish and Game did initiate a fall chinook reintroduction program in the upper Clearwater River subbasin prior to dam removal from 1960-1968. This effort was primarily through eyed egg outplants in the Selway River and some fry outplants in the Middle Fork Clearwater. Adult returns were counted at the Washington Water Power Dam in subsequent years and a high of 122 adults were counted in 1966, however, the reintroduction program was terminated because of insignificant returns (Hoss 1970). Nothing was done to monitor returns or enhance fall chinook production in the Clearwater River after the Washington Water Power Dam removal in 1972.

The Mainstem Clearwater River Study: Assessment for Salmonid Spawning, Incubation and Rearing initiated fall chinook studies once again in 1988 (Arnsberg et al. 1992). A total of 21 fall chinook redds were counted during 1988 in the lower Clearwater River. Arnsberg et al. (1992) documented the presence of an abundance of quality mainstem river fall chinook salmon spawning habitat through an intensive instream flow study. This study recommended flow and temperature releases from Dworshak Dam that would be favorable to recovery of Snake River fall chinook salmon in the lower Clearwater River. Arnsberg et al. (1992) also recommended supplementation using Lyons Ferry Hatchery reared fall chinook to enhance natural production in the lower Clearwater River before the fish were listed under the ESA. Lyons Ferry Hatchery, built in 1982 below Little Goose Dam on the lower Snake River, is the only hatchery that mitigates for Snake River fall chinook losses. However, mitigation of fall chinook has been mainly through releases at the hatchery and supplementation did not begin in natural production areas above Lower Granite Dam until 1996 on the Snake River and 1997 on the Clearwater River.

The current study is a follow-up study for information needed on juvenile fall chinook life history characteristics and survival in the lower Clearwater River in relation to flow and water temperature releases from Dworshak Dam and to identify other mainstem habitats for recovery efforts. We evaluated potential and vacant summer and fall chinook habitat in the upper Clearwater River and principle tributaries including the Middle Fork Clearwater, South Fork Clearwater, Lochsa, and Selway and other important spawning habitats were identified in the lower Grande Ronde, Imnaha, and Salmon Rivers where fall chinook spawning has been documented (Arnsberg 1998). Since the beginning of this project in 1994, we investigated the movement patterns, growth rates, and survival of naturally produced (wild) subyearling fall chinook salmon in the lower Clearwater River. We believe juvenile mortality through the hydro system is extremely high and accurate survival measurements are key to realizing the recovery potential. This is especially true for fall chinook which emigrate primarily as subyearlings during lower summer flows and warmer water temperatures. We used passive integrated transponder (PIT) tags to measure fall chinook emigration survival from the Clearwater River through the lower Snake River dams. Due to the low numbers of wild fish available for capture and PIT tagging, Lyons Ferry Hatchery fall chinook subyearlings (Snake River stock) has been used as surrogates for wild fish since 1996 (Muir et al. 1998). Evaluation of the survival data to date indicates that fish released earlier in the year and at a larger size have higher survival through the lower Snake River dams. Juvenile fall chinook survival studies should continue for at least five consecutive years under a range of environmental conditions. We will begin supplementation efforts and evaluations in other study streams as enough fall chinook become available. We collected life history and survival information on wild fall chinook salmon in the Grande Ronde River during 1997 and 1998 and will continue this work in the future.

The NMFS Proposed Recovery Plan for Snake River Salmon Chapter V, Section 4, p V-4-15 Monitoring and Evaluation Strategy states: “supplementation studies are long-term and may extend for 15 years and preliminary information should be available after five years” and “The fisheries agencies and the Tribes should also conduct spawning ground surveys and initiate genetic monitoring programs for natural populations that may be affected by stray fish.” In cooperation with the NMFS and USFWS, we began supplementation survival studies in the Snake River Basin using Lyons Ferry Hatchery fall chinook in 1996 (Muir et al. 1998) as enough fish were not available in 1994 and 1995 because of low adult returns. During 1997 and 1998, enough hatchery fish were available to expand the supplementation survival studies in the Clearwater River using the expermental study design as described in Arnsberg and Steward (1995). These results will be reported in a 1997-98 report to BPA. We initiated fall chinook redd surveys in the lower Clearwater River in 1988 (Arnsberg et al. 1992). The current project continues to assess fall chinook spawning escapement to the Clearwater River and mainstem tributaries. We began redd surveys in the lower Salmon River in 1994. We are working in cooperation with the U.S. Fish and Wildlife Service and Idaho Power Company on conducting fall chinook redd surveys and collection of carcasses in the Grande Ronde and Imnaha Rivers. We have assisted in the Grande Ronde River redd surveys since we initiated habitat evaluations for fall chinook recovery and are collecting carcasses for

biological information. All fall chinook carcasses observed from redd surveys were examined and biological information collected, and hatchery contributions, and "stray" fish assessed each year since redd surveys began in 1988. Genetic monitoring of naturally produced fish began in the Clearwater and Grande Ronde Rivers in 1998 and samples were sent to the Washington Department of Fish and Wildlife laboratory in Olympia for electrophoretic analysis to describe the current fall chinook stock structure. There has been an unknown number of mid-Columbia River fall chinook "strays" above Lower Granite Dam since the late 1980's (Chapman et al. 1991). Past and current spawning protocols at Lyons Ferry Hatchery may have resulted in the hatchery stock being more closely related genetically to the original Snake River stock than what now exists in the natural spawning population (Blankenship et al. 1997). Knowing the current genetic makeup of the fall chinook spawning in the Snake River Basin is important to recovery because the NMFS has treated the Snake River fall chinook as a separate ESU and has called for selectively removing "strays" at the Lower Granite fish trap. Besides collecting juveniles for genetic analysis, we began in 1997 to archive fins from adult carcasses collected from the spawning areas for future DNA analysis.

b. Rationale and significance to Regional Programs

The Goals of the 1994 Fish and Wildlife Program also calls on Fishery Managers "...as quickly as possible and in consultation with the National Marine Fisheries Service, develop an experimental design for implementing, monitoring and evaluating supplementation of and, if appropriate, a captive broodstock program for Snake River fall chinook." We believe a captive broodstock program is not yet warranted for the Snake River fall chinook and would be a last resort to try and recover the stock. Adult fall chinook counts at Lower Granite Dam have been increasing during recent years and supplementation efforts appear to be contributing. During 1998, the jack number over Lower Granite Dam indicates the adult number will continue to increase in the near future. The NMFS mandated flow targets at Lower Grainte Dam during the fall chinook emigration period during summer and the extensive use of cold Dworshak Reservoir water to cool the Snake may be increasing emigration survival and hence adult returns. Arnsberg and Statler (1995) reported that these unnaturally high (up to 25 times the historical flow) and cold water releases may be negatively affecting rearing ESA listed fall chinook in the lower Clearwater River. It will be important to the recovery of the Snake River fall chinook to bring together all existing flow and temperature data along with past dam operations, juvenile emigration survival, and adult return information to better understand the management implications as it relates to recovery. Future monitoring of the Snake River fall chinook will be especially important to evaluate proposed changes in the existing hydro system.

The National Marine Fisheries Service (NMFS) Proposed Recovery Plan for Snake River Salmon (March, 1995), Chapter V, Section 4, p V-4-40 4.7 Biological Objective states: "Restore listed chinook salmon by reintroducing them into historic habitat" and Chapter V, Section 4, p V-4-43 4.8 Biological Objective states: "Conduct research to facilitate management that optimizes hatchery production and conserves natural populations." We have identified and evaluated potential and vacant summer and fall chinook habitat in the

upper Clearwater River and principle tributaries including the Middle Fork Clearwater, South Fork Clearwater, Lochsa, and Selway and other important spawning habitats in the lower Grande Ronde, Imnaha, and Salmon Rivers (Arnsberg 1998). The NMFS Proposed Recovery Plan for Snake River Salmon (March, 1995) Chapter V, Section 4 p V-4-42 4.7.d states to: "Reintroduce spring/summer chinook salmon in the Lochsa and Selway River once an appropriate stock is identified." An October spawning summer chinook with a subyearling emigration life history (mid-Columbia stock) was recommended for reintroduction in the lower Selway River based on current habitat conditions (Cramer 1995; Arnsberg and Statler, 1995). Because of ESA concerns to the Snake River fall chinook, NMFS will currently not support out-of-basin stock transfers. Since a true October spawning summer chinook is now extinct in Idaho, we recommended an early spawning Snake River fall chinook as outlined in the Broodstock Management Plan for fall chinook in the Clearwater River subbasin (Steward and Arnsberg 1998). This plan will aid Nez Perce Tribal Hatchery (BPA Project 8335000) managers in the selection and mating protocols of Snake River fall chinook.

This project mitigates for losses in place and in kind for summer and fall chinook salmon stocks in the Clearwater River subbasin as the result of the Clearwater dams and mitigates for losses in place and in kind for the summer and fall chinook in the lower Salmon, Grande Ronde, and Imnaha Rivers as a result of the construction and operation of the Snake River dams.

c. Relationships to other projects

Project 9102900 is assessing fall chinook spawning habitat availability and quality, juvenile life history characteristics and emigration survival in the mainstem Snake River and we are doing similar work in the remaining fall chinook production areas above Lower Granite Dam. Project cooperation includes: describing juvenile life history characteristics of wild and Lyons Ferry Hatchery supplemented fall chinook, emigration survival as it relates to environmental conditions, conducting fall chinook aerial redd surveys and documenting hatchery fish contributions to the natural spawning population.

Project 9302900 evaluated the emigration survival of supplemented fall chinook (non-Snake River stock) in the Snake River above Lower Granite Dam during 1995. From 1996-1998, we worked cooperatively with the NMFS and USFWS to evaluate emigration survival of supplemented Lyons Ferry Hatchery fall chinook (Snake River stock) subyearlings in the Snake and Clearwater Rivers. A cooperative 1996 Annual Report has been submitted to BPA for publication (Muir et al. 1998). A draft 1997 Annual Report is being reviewed. We coordinate our request for Lyons Ferry Hatchery subyearling fall chinook salmon with USFWS, NMFS, and the WDF and through the *U.S. v. Oregon* Production Advisory Committee.

We are also working closely with NPT Project 9801004: Monitoring and Evaluation of Yearling Snake River Fall Chinook Outplanted Upstream of Lower Granite Dam. We share equipment and personnel with this project. Project goals are basically the same which is to restore fall chinook salmon in the Snake River Basin above Lower Granite

Dam. We will also be working closely with NPT Project 9801005 at the portable acclimation facilities operated by the Tribe. Research subyearling fall chinook salmon from Lyons Ferry Hatchery will be acclimated at the Big Canyon Creek Acclimation Facility on the Clearwater River during a six week period following the release of production yearling fall chinook. Lyons Ferry Hatchery production subyearlings will also be monitored by this project when they are available for acclimation and release at the Big Canyon facility.

d. Project history (for ongoing projects)

This project is a follow-up study from the Mainstem Clearwater Study (Arnsberg et al. 1992) to evaluate potential and vacant habitat for summer and fall chinook in the upper Clearwater River, its major tributaries (Middle Fork Clearwater, South Fork Clearwater, Lochsa, and Selway), and the lower Grande Ronde, Imnaha, and Salmon Rivers for recovery and restoration. During the first year (1994), we evaluated water temperatures during critical life stages of egg incubation and juvenile rearing (Arnsberg and Statler, 1995). During 1995-1996, we measured the quantity and quality of spawning habitat available in the upper Clearwater River and major tributaties (Arnsberg 1998).

From 1994-1998, we investigated the movement patterns, growth rates, and survival of wild subyearling chinook salmon in the lower Clearwater River to Lower Granite Dam through the use of PIT tags. Wild juvenile fall chinook survival studies will continue and supplementation will begin in other study streams as fish become available. During 1997-1998, we are quantitatively and qualitatively evaluating potential chinook salmon spawning habitat in the lower Grande Ronde, Salmon, and Imnaha Rivers. We began collecting life history and survival information on wild juvenile fall chinook salmon in the Grande Ronde in 1997 and will do the same on the lower Salmon and Imnaha Rivers if adult spawning escapement increases. This project promotes adaptive management by evaluating fall chinook survival and life history characteristics during varying environmental conditions and management regimes of controlled flows and water temperature releases.

Quarterly Progress Reports have been submitted to BPA since this project's inception. A 1994 Annual Report has been published by BPA (Arnsberg and Statler 1995). A combined 1995-96 draft final report is being reviewed (Arnsberg 1998). A cooperative 1996 BPA Annual Report has been published by BPA (Muir et al. 1998) and a draft 1997 report is being reviewed.

Project costs since start-up in February 1994 have been: 1994 - $241,262; 1995 - $225,991; 1996 - $225,953; 1997 - $285,071; 1998 - $197,000; 1999 - $304,800. PIT tag costs in 1998 and 1999 represent $92,800 per year.

e. Proposal objectives

Objective 1: Describe the movement patterns, growth rates, life history characteristics, emigration survival, and stock structure of wild and hatchery fall chinook released in the

Clearwater and Grande Ronde Rivers. Survival research of Lyons Ferry Hatchery fall chinook subyearlings through the lower Snake River dams began in the lower Clearwater River during 1996 in cooperation with the NMFS (Muir et al. 1998). These were direct steams releases and we cooperated in similar studies in 1997 and 1998. A cooperative 1997 report is being reviewed.

Ho1a: Acclimation of hatchery fall chinook subyearlings does not improve emigration survival through the mainstem dams. Corollary: A detectable difference in emigration survival will be observed in acclimated hatchery versus direct stream released fall chinook.

We began supplementation survival research in 1997 and acclimated replicate release groups at the Big Canyon Creek Acclimation Facility prior to release. Generally, fishery managers believe that acclimation is essential prior to release of supplemented fish for the highest return of adults to the stream of supplementation. We have captured and PIT tagged wild fall chinook subyearlings in the Clearwater River since 1994 and in the Grande Ronde River since 1997 to describe life history characteristics and survival of naturally produced juvenile fall chinook salmon through the lower Snake River dams.

Ho1b: No difference in emigration survival and travel times occurs between Lyons Ferry Hatchery subyearling fall chinook and wild fall chinook regardless of size and time of release. Corollary: A detectable difference in the emigration survival and travel times will be observed between hatchery and wild fall chinook released at different sizes and times.

Ho1c: No difference in genetic stock structure will be observed between the wild fall chinook above Lower Granite Dam and the samples taken in previous years and the known Lyons Ferry Hatchery stock. Corollary: A detectable difference in the genetic stock structure of the Snake River fall chinook will be observed.

Obtain a subsample of up to 120 wild chinook salmon from each study stream for chinook stock identification i.e. either spring/summer or fall chinook and to describe genetic stock structure i.e. Snake River and/or mid-Columbia River fall chinook This is important for the recovery of Snake River fall chinook because there has been recent evidence of “genetic contamination” from fall chinook strays, especially from the Umatilla River (Blankenship et al. 1997).

Objective 2: Determine fall chinook adult escapement and spawning success in the Clearwater, Grande Ronde and Salmon Rivers and coordinate with the USFWS and Idaho Power Company on the Snake and Imnaha Rivers. We continued conducting fall chinook redd surveys in the Clearwater subbasin since this project began. The lower Salmon River was included in redd surveys in 1994. We reported on redd locations and hatchery contributions in our 1994 Annual Report (Arnsberg and Statler 1995) and our 1996-97 Report (Arnsberg 1988). We are working in cooperation with the U.S. Fish and

Wildlife Service and Idaho Power Company on fall chinook redd surveys and carcass collections in the Grande Ronde and Imnaha Rivers.

Objective 3: Correlate juvenile wild and hatchery fall chinook survival in study streams to emigration conditions and environmental variables to adult returns. Flow, water temperature, and dam operation data are being gathered to explain differences in year-to-year juvenile survival, release timing and size information, and subsequent adult return numbers.

Ho3: There will be no relationship between juvenile emigration survival and water temperature and flows or release time or fish size. Corollary: A correlation between juvenile survival and dam discharge, water release temperatures, and release timing and size will be observed.

Objective 4: Provide reports on the technical findings, project status, and budget status. Quarterly progress reports have been provided and will be provided to BPA. A 1994 Annual Report has been published by BPA (Arnsberg and Statler 1995). A draft combined 1995-96 Report is being peer reviewed (Arnsberg 1998). A 1997-98 Report is being compiled and will be provided to BPA by April 1999. Annual reports will be provided to BPA in the future. Papers on applicable results will be submitted for scientific journal publication where appropriate and presented orally in scientific forums.

f. Methods

Objective 1. Describe the movement patterns, growth rates, life history characteristics, emigration survival, and stock structure of wild and hatchery fall chinook released in the Clearwater and Grande Ronde Rivers. Snake River fall chinook subyearlings will be requested from Lyons Ferry Hatchery to assess emigration timing, travel times, growth rates, and survival from the lower Clearwater River to the mainstem dams. A total of 24,000 PIT tagged hatchery subyearlings at two sizes (75 and 95 mm) will be acclimated for a week at the Big Canyon Creek Acclimation Facility and released into the Clearwater River over a six week period (4 replicates of 500 fish of each size). Sample sizes were based on an experimental study design (Arnsberg and Statler 1995). In cooperation with the NMFS, another 1,250 PIT tagged hatchery subyearlings will be direct stream released on each date as the acclimated fish groups for a total of 7,500 fish. Sample sizes were based on sample means and variances obtained for the 1996 study (Muir et al. 1998), and preliminary data from the 1997 and 1998 survival studies on the Snake and Clearwater Rivers. Survival rates will be compared to wild fall chinook subyearlings captured and PIT tagged (up to 4,000) in the lower Clearwater and Grande Rivers. Recapture information of wild and Lyons Ferry Hatchery subyearling fall chinook will provide details on movement patterns, habitat use, and growth rates. We will obtain a subsample of up to 120 wild chinook salmon from the PIT tag groups in each study stream for chinook stock identification i.e. either spring/summer or fall chinook and to describe the fall chinook stock structure i.e. Snake versus Columbia River stock. It is important in describing life history characteristics that the stock of wild subyearlings that are tagged

are indeed fall chinook and not spring chinook which may rear in lower mainstem reaches. Also, with the recent number of "stray" fall chinook reported over Lower Granite Dam, it will be essential to management of these stocks to examine the existing stock structure of the Snake River fall chinook. Subyearling fall chinook samples will be sent to the Olympia, WA, Laboratory of the Washington Department of Fish and Wildlife for genetic analysis using electrophoretic techniques. Fall chinook fin clips will also be sent to the USGS Laboratory in Seattle, WA for DNA analysis as a comparison of spring vs fall chinook and to look at genetic markers to separate out fall chinook stocks. Expected results are that a high percentage of juvenile chinook collected will be the fall chinook stock, however, there may be a higher degree of overlap in the genetic structure with the mid-Columbia River fall chinook stock.

The Survival Under Proportional Hazards (SURPH) model (Smith et al. 1994) will be used to estimate juvenile emigration survival to the mainstem dams. ANOVA will be used to measure statistical survival differences between hatchery and wild fall chinook releases. We will also compare subyearling to yearling survival as reported by Project 9801004 and relate this information to smolt-to-adult survival from different supplementation strategies in the Snake River basin. Results so far have indicated that the larger fish released earlier in the year survive better at least to the downstream dams than smaller fish released later in the summer (Muir et al. 1998). Tasks outlined in Section 4 that relate to Objective 1 and methods described above are Tasks 1a through Task 1f.

Objective 2: Determine fall chinook adult escapement and spawning success in the Clearwater, Grande Ronde and Salmon Rivers and coordinate with the USFWS and Idaho Power Company on the Snake and Imnaha Rivers. We will continue to conduct aerial fall chinook spawning ground surveys by helicopter to determine adult escapement and spawning locations in the Clearwater, Grande Ronde, and Salmon Rivers and coordinate with the USFWS and Idaho Power Company on redd numbers, location, and carcass collections on the Imnaha River. Redds will be mapped on each survey and verified from the ground to document spawning escapement and locations. Biological information from carcasses will be collected to determine sex, size, age (from scale analysis), percent spawned, and the percent hatchery contributions to natural production. Hatchery fish contributions will be made by identifying an adipose clip, other fin clip, or elastomer tag on adults, and through the collection of snouts for coded wire tag (CWT) information. Snouts will be sent to the Washington Department of Fish and Wildlife for CWT extraction and tag reading. An increase in adult escapement and successful contribution to the natural spawning population by hatchery fish is expected in the near future from fall chinook supplementation in the basin. In fact, the jack count at Lower Granite Dam in 1998 from the supplemented fish releases at Pittsburg Landing on the Snake and Big Canyon on the Clearwater River has been higher than expected (643 jacks as of 11/4/98) and should be an indication of good returns at least in the next two years.

We will conduct fall chinook deep water redd surveys using underwater video in systematic sampling locations in the Clearwater River to determine the extent of deep water spawning. An underwater video camera mounted on a weighted sled will be

lowered to just off the stream bottom by an instream flow cable setup mounted in front of a jet boat. We will search deep water areas where fall chinook spawning substrate is expected and where redds have been seen from the air when water transparency was excellent but not common on all aerial surveys. Tasks outlined in Section 4 that relate to Objective 2 and methods describe above are Task 2a through Task 2d.

Objective 3: Correlate juvenile wild and hatchery fall chinook survival in study streams to emigration conditions and environmental variables to adult returns. We will correlate (using multivariate analysis and ANOVA) wild and hatchery juvenile fall chinook growth and survival information as described in Objective 1 with flow and water temperatures releases from Dworshak Dam and in the Snake River during emigration and compare to previous years data. Through adult return information collected in Objective 2, we will calculate the smolt-to-adult survival for all subyearling and yearling fall chinook release groups in the Snake River basin. We will calculate and compare smolt-to-adult survival versus various release strategies based on CWT, elastomer tags, and PIT tagged adult returns to Lower Granite Dam and through carcass collections on the spawning grounds. Expected survival of subyearling and yearling fall chinook releases from Lyons Ferry Hatchery has been higher than expected because of several good water years in a row. Therefore, adult returns are expected to be higher than normal in the future which will enhance our ability to predict smolt-to-adult survival from various supplementation strategies. Temperatures in all study streams will be continuously monitored to assess juvenile rearing and emigration conditions and to relate smolt-to-adult survival. Tasks outlined in Section 4 that relate to Objective 3 and the methods describe above are Task 3a and Task 3b.

g. Facilities and equipment

(This project is based out of the Nez Perce Tribe Orofino Fisheries Field office in which office space is shared with other BPA funded projects and is adequate for the research and monitoring and evaluation studies.

One jet boat capable of negotiating whitewater has been purchased for the project for juvenile collections, habitat assessments, deep water redd counts, redd truthing, and carcass collections. An underwater video camera has been purchased to assist in searching for deep water fall chinook redds in study streams. Two seines have been purchased for collecting juveniles along beaches by jet boat. This boat is also used in another BPA project (9801004) for radio telemetry studies of yearling fall chinook supplemented upstream of Lower Granite.

The project currently has one personal computer and one laptop computer for field use such as PIT tagging and downloading thermographs in which eight Hobos have been purchased. One backpack PIT tag station suitable for field applications and all standard PIT tagging equipment (syringes, needles, MS-222, aeration systems, etc.) has been purchased by the project. A total of 24,000 PIT tags were used for fall chinook supplementation survival research in 1997 and 1998, 10,000 tags were used in 1997 for production subyearlings released from the Big Canyon Creek Acclimation Facility on the

Clearwater River to assess juvenile survival, and 8,000 tags are scheduled to be used in wild subyearlings on the Clearwater and Grande Ronde Rivers each year to assess juvenile survival.

The project has one leased GSA fleet pickup truck capable of pulling a jet boat and transporting a crew of four which is required for seining juveniles. A GSA fleet mini-van will be leased in 2000 for general project transportation.

h. Budget

Personell costs includes 1.0 FTE Project Leader, 0.5 FTE Assistant, and 1.0 FTE Fisheries Technician. Administration costs includes 0.1 FTE for Program Manager, Contract Administrator, Program Leader, and Secretary, and 0.05 FTE Fisheries Research Coordinator.

Section 9. Key personnel

Billy D. Arnsberg, Project Leader is responsible for: assessing summer and fall chinook salmon restoration in the Snake River basin. The Project Leader shall coordinate summer and fall chinook salmon research with the Bonneville Power Administration, U.S. Fish and Wildlife Service, National Marine Fisheries Service, U.S. Forest Service, Washington Department of Fisheries, Oregon Department of Fish and Wildlife, Idaho Department of Fish and Game and other agencies as required. The Project Leader will work closely with the Nez Perce Tribal Hatchery Monitoring and Evaluation studies and Project 9801004: Monitoring and Evaluation of Lyons Ferry Hatchery Fall Chinook released upstream of Lower Granite Dam. The Project Leader is responsible for administrating Bonneville Power Administration contracts and conducting evaluation studies for the Nez Perce Tribe including development of budgets, plan of operation, monitoring expenditures, statements of work, reporting and coordinating office and field work with management staff. The Project Leader is also responsible for maintaining written records of interactions with funding agencies, reviewing agencies and co-management agencies, write and publish meeting, progress and annual reports, maintain a data base, correspond orally and in writing with supervisory staff and co-management agencies. The Project Leader provides management, training and supervision of full time and temporary personnel for conducting an evaluation of summer and/or fall chinook salmon restoration potential in mainstem rivers. The Project Leader will act as a technical representative of the Nez Perce Tribe on multi-agency committees for coordination and planning of chinook salmon assessment and restoration in mainstem rivers, including hatchery management, supplementation and natural production.

RESUME: Billy D. Arnsberg

EDUCATION:

UNIVERSITY OF IDAHO, MOSCOW, ID. 1987-1990. M.S. coursework in Fisheries Science. Thesis entitled: Food Availability and Diet of Fish in Little Payette Lake Before and After Rotenone Treatment.

UNIVERSITY OF MISSOURI, COLUMBIA, MO. 1982-1984. B.S. Degree in Fisheries and Wildlife Management.

SOUTHEAST MISSOURI STATE UNIVERSITY, CAPE GIRARDEAU, MO. 1980-1982.

EXPERIENCE:

NEZ PERCE TRIBE, LAPWAI, ID. 1989-Present. Fisheries Research Project Leader. Researcher and primary author of the Mainstem Clearwater River Study: Assessment for Salmonid Spawning, Incubation, and Rearing, BPA Project 88-15. Project Leader for two years on Salmon Supplementation Studies in Idaho Rivers, BPA Project 8909802. Currently Project Leader for Assessing Summer and Fall Chinook Salmon Restoration in the Snake River Basin (BPA Project 9403400).

IDAHO DEPARTMENT OF FISH AND GAME, McCALL, ID. 4/86-9/88. Fisheries Research Technician.

DWORSHAK NATIONAL FISH HATCHERY, AHSAHKA, ID. 12/86-4/87. Fisheries Biological Aide.

McCALL FISH HATCHERY, McCALL, ID. 10/86-12/86. Fisheries Biological Aide.

MISSOURI DEPARTMENT OF CONSERVATION, COLUMBIA, MO. 1/85-12/85 and 9/85-12/85. Wildlife Research Technician.

U.S. FISH AND WILDLIFE SERVICE, SASKATCHEWAN, CANADA. 4/85-9/85. Wildlife Research Technician.

MISSOURI DEPARTMENT OF NATURAL RESOURCES, COLUMBIA, MO. 5/84-10/84. State Park Ranger.

UNIVERSITY OF MISSOURI, COLUMBIA, MO. 5/82-5/84. Fisheries Research Technician.

PUBLICATIONS:

Muir, W.D., S.G. Smith, E.E. Hockersmith, M.B. Eppard, W.P. Connor, and B.D. Arnsberg. 1998. Passage survival of hatchery subyearling fall chinook salmon to Lower

Granite, Little Goose, and Lower Monumental Dams, 1996. Annual Report to the Bonneville Power Administration, Project 9102900.

Arnsberg, B.D. 1998. Assessing summer and fall chinook salmon restoration in the Snake River basin. Nez Perce Tribe Department of Fisheries 1995-96 Report to the Bonneville Power Administration, Project 94-034.

Arnsberg, B.D and D.P. Statler. 1995. Assessing summer and fall chinook salmon restoration in the upper Clearwater River and principal tributaries. 1994 Annual Report prepared for the U.S. Department of Energy, Bonneville Power Administration, Contract No. DE-BI79-87BI12872, Project No. 94-034.).

Arnsberg, B.D., W.P. Connor, and E. Connor. 1992. Mainstem Clearwater River study: assessment for salmonid spawning, incubation, and rearing. Project 88-15. Final Report to Bonneville Power Administration, Portland, OR.

Connor, W.P., B.D. Arnsberg, and E. Connor. 1990. Mainstem Clearwater River study: assessment for salmonid spawning, incubation, and rearing. Project 88-15. Annual Report to Bonneville Power Administration, Portland, OR.

Mark Pishl is the Fisheries Technician for the Assessing Summer and Fall Chinook Restoration in the Snake River basin project. Mr. Pishl has 10 years experience working for the Nez Perce Tribe and is currently a lead Fisheries Technician. Mr. Pishl has taken one semester of course work at the University of Idaho and has completed a Fisheries Conservation Management class at Lewis Clark State College. This position fills 1 FTE.

Paul Kucera is the program leader for the Assessing Summer and Fall Chinook Restoration in the Snake River basin project. Mr. Kucera has 23 years professional experience as a Fisheries Biologist in research, management and administration and is a Certified Fisheries Scientist through AFS. He has authored or co-authored seven peer-reviewed fisheries journal publications, and over 40 other project related reports. Responsible for technical program direction and administration of the Fisheries Research Division. This position fills 0.1 FTE.

Education:	Bachelor of Science, 1975 Major: Fisheries Management	Utah State University
	Graduate Studies, 1984-1987 Major: Fisheries Management	University of Idaho

Jay Hesse is the Research Coordinator for the Assessing Summer and Fall Chinook Restoration in the Snake River basin project. Mr. Hesse has seven years professional experience as a Fisheries Research Biologist and as the Research Coordinator. Responsible for technical direction and supervision of fisheries research projects,

research coordination and development, and Tribal fisheries research representation at federal and state metings. This position fills 0.05 FTE.

Education:	Bachelor of Science, 1992 Major: Fisheries	Michigan State University
	Masters of Science, 1994 Major: Fisheries and Wildlife	Michigan State University

Section 10. Information/technology transfer

Annual reports will be written on the results of all objectives and tasks outlined above and scientific journal publications will be submitted on the most contributing results to restore chinook salmon stocks in the Snake River Basin. The Final Project Report will include updated flow and temperature release recommendations which will support the recovery of fall chinook salmon in the Snake River Basin. Oral presentations of study results will be made in regional forums and at the American Fisheries Society meetings.

Congratulations!